

## **REMARKS**

Claims 21-53 are pending in the application. Favorable reconsideration of the application is respectfully requested in view of the following remarks.

### ***I. Allowable Subject Matter***

Applicant acknowledges the Examiner's conclusion that claims 26, 41, and 43 recite allowable subject matter. The Examiner objects to such claims as depending from a rejected base claim, but states these claims would be allowed if rewritten in independent form including the limitations of the base claim and any intervening claims. As further explained below, however, Applicant asserts these claims are patentable in their current form, and therefore the objections should be withdrawn.

### ***II. Objections to the Drawings***

The Examiner objects to Figs. 10 and 11 in that such figures should be labeled "Prior Art" or comparable. In accordance with the Examiner's comments, a replacement drawing sheet containing Figs. 10 and 11 labeled as "Conventional Art" is being submitted herewith. The objection, therefore, should be withdrawn.

### ***III. Objections to the Specification***

The Examiner objects to the title of the invention as being insufficiently descriptive. In accordance with the Examiner's comments, the title of the invention is amended as follows: "MICRO ACTUATOR HAVING TILT AND VERTICAL DISPLACEMENT AND DEVICE HAVING SUCH MICRO ACTUATOR." The objection, therefore, should be withdrawn.

### ***IV. Rejections Under 35 U.S.C. § 103(a)***

Claims 21-25, 27-34, 36-40, 42, 44-52 stand rejected pursuant to 35 U.S.C. § 103(a) as being obvious over Aubuchon, U.S. Patent No. 6,906,848 (Aubuchon), in view of Greywall, U.S. Patent No. 6,690,850 (Greywall). Claims 35 and 53 stand rejected pursuant to 35 U.S.C. § 103(a) as being obvious over Aubuchon and Greywall, and further in view of a more tertiary reference, Mushika, WO Publication No. 021061488 as partially translated as U.S. Patent No. 6,952,304 (Mushika). Applicant traverses the



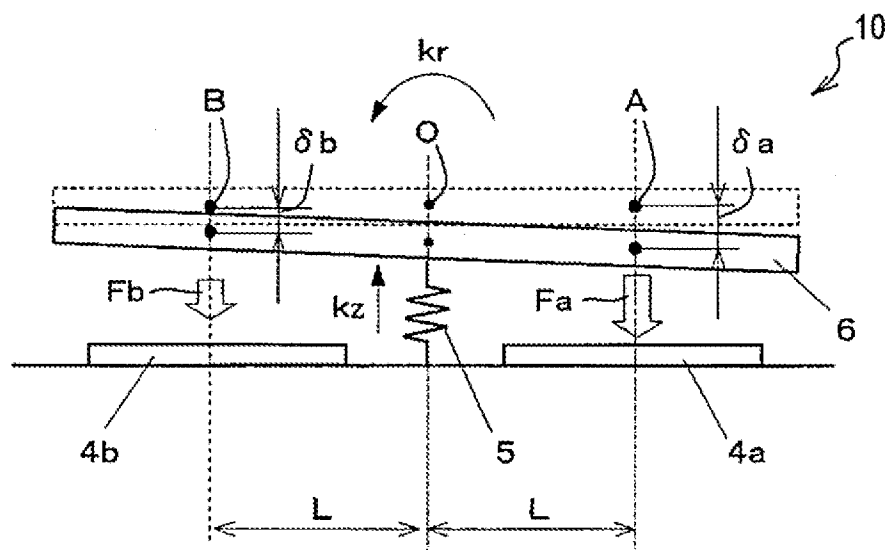
rejections for at least the following reasons.

The claimed invention provides a microactuator in which a non-diagonality between the driving force and displacement of a movable section is reduced as compared to conventional configurations. For example, claim 21 recites that an elastic supporting member supports the movable section at a position intermediate between a first point of application of a first driving force which is exerted by the first driving section on the movable section and a second point of application of a second driving force which is exerted by the second driving section on the movable section. Claim 21 further recites a relationship among the parameters  $k_z$ ,  $k_r$ , and  $L$  as follows:

$$0.5 \leq L^2 \cdot k_z / k_r \leq 2,$$

where (1)  $k_z$  is a spring modulus of a restoring force occurring in the elastic supporting member responsive to a displacement of the movable section relative to the base along the vertical direction; (2)  $k_r$  is a spring modulus of a restoration torque occurring in the elastic supporting member responsive to a tilt angle of the movable section relative to the base; and (3)  $2L$  is a distance between the first point of application and the second point of application. Fig. 2a of the application is reproduced below as representative of these features.

**FIG. 2B**





As seen in the above figure, an elastic member 5 supports a moveable electrode 6 intermediate between two driving forces  $F_a$  and  $F_b$  that may be applied at application points A and B, the application points A and B being a distance of  $2L$  apart. Also,  $k_z$  indicates the referenced spring modulus of a restoring force occurring in the elastic supporting member, and  $k_r$  indicates the referenced spring modulus of a restoration torque occurring in the elastic supporting member. Similar features are recited in claim 36 regarding a positioning of an elastic member and a mathematical relationship relating associated spring moduli.

The cited references do not disclose or suggest such features. The Examiner relies on Aubuchon as teaching the basic microactuator structure enabling vertical and tilt displacement relative to the base. The Examiner admits that Aubuchon does not teach the particular relationship between the spring modulus of the restoring force, restoration torque and distance as recited in claims 21 and 36. However, the Examiner argues that Greywall teaches that the spacing and length of the spring  $L$  together with the spring modulus are “result effective” variables. Applicant disagrees with the Examiner’s application of the references.

First, the references do not disclose or suggest that the elastic supporting member supports the movable section at a position intermediate between a first point of application of a first driving force and a second point of application of a second driving force, as recited in independent claim 21. Figs. 3a and 3b of Aubuchon are reproduced below as representative.

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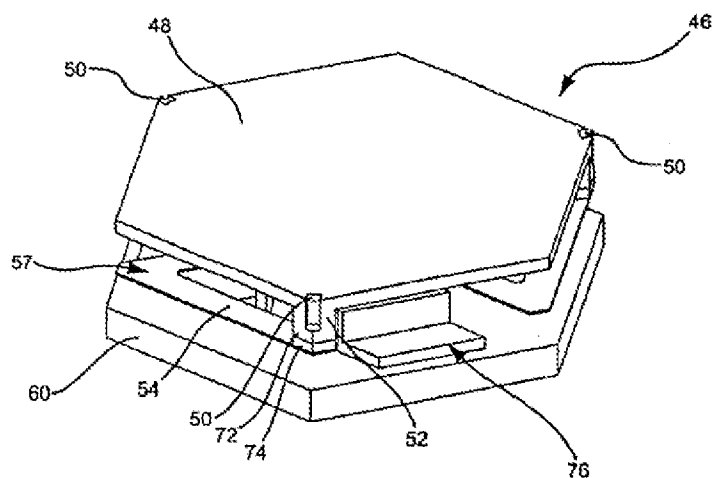


FIG. 3A

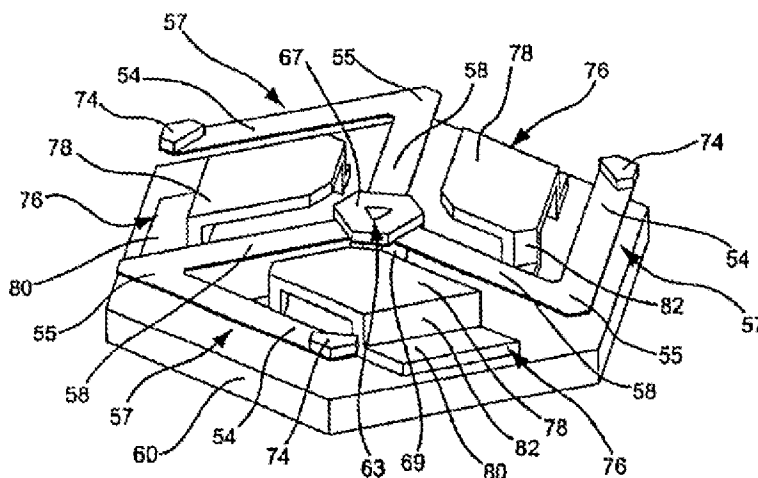


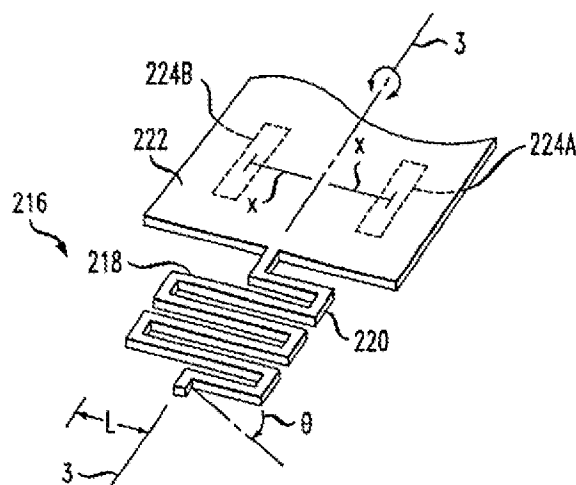
FIG. 3B

As seen in the above figures, in Aubuchon hinge 57 having hinge portions 58 supports the mirror 48 along spokes that extend from the center and move along the outer periphery. The hinge 57 thus does not support the mirror 48 at an intermediate position between two driving forces separated by a distance  $2L$  as claimed.

The Examiner relies on Greywall at col. 6, lines 25-57 as disclosing the pertinent claim features. This passage of Greywall describes Fig. 2, which also is reproduced below.



FIG. 2



As seen in the above figure, and as described in the passage cited by the Examiner, a serpentine element 216 supports a movable member 222 at a position adjacent to and displaced from the member 222. Thus, element 216 does not support the member 222 at an **intermediate position between two driving forces** as claimed.

It necessarily follows that the references, particularly Greywall as relied upon by the Examiner, do not disclose or suggest the claimed mathematical relationships, as recited for example in claims 21 and 36. The claimed relationships are introduced in addressing a “non-diagonality”  $\delta b/\delta a$  formed by a displacements  $\delta a$  and  $\delta b$  in above Fig. 2B (also  $\delta'/\delta$  formed by displacements  $\delta'$  and  $\delta$  in FIG. 2A). (See Application at paragraphs [0051-0065].) With reference to Figs. 2 and 3, Greywall merely discloses that the plate rotation increases as the parameter  $x/L$  (see above Fig. 2 of Greywall) increases. Greywall does not disclose or suggest the claimed spring moduli  $k_z$  and  $k_r$  as they relate to the referenced non-diagonality.

For at least the foregoing reasons, a combination of Aubuchon and Greywall does not result in, disclose, or suggest the invention as recited in claim 21. A similar analysis applies to the specific relationships recited in claim 36. The tertiary reference, Mushika, does not make up for the above deficiencies of Aubuchon and Greywall, and the Examiner does not indicate otherwise. Accordingly claims 21 and 36, and therefore



the dependent claims, are not obvious over the cited references, and the rejections should be withdrawn.

**V. Conclusion**

For the foregoing reasons, claims 21-53 are believed to be allowable and the application is believed to be in condition for allowance. A prompt action to such end is earnestly solicited.

Should the Examiner feel that a telephone interview would be helpful to facilitate favorable prosecution of the above-identified application, the Examiner is invited to contact the undersigned at the telephone number provided below.

Should a petition for an extension of time be necessary for the timely reply to any outstanding Office Action (or if such a petition has been made and an additional extension is necessary), petition is hereby made and the Commissioner is authorized to charge any fees (including additional claim fees) to Deposit Account No. 18-0988, Docket No. OKUDP0178US.

Respectfully submitted,

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